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Indian Standard

CODE OF SAFETY FOR PHTHALIC ANHYDRIDE

(First Reprint MARCH 1983)

UDC 614.878 : 547.584

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3 *February* 1975

AMENDMENT NO. 1 DECEMBER 2006
TO
IS 7420 : 1974 CODE OF SAFETY FOR PHTHALIC ANHYDRIDE

(*Page* 4, *clause* **3)** — Insert the following new clause at the beginning and renumber the subsequent clause.

'3.1 General Information

a) Molecular formula : $C_6H_4(CO)_2O$
b) Molecular weight : 148.11
c) CAS No : 85-44-9
d) UN No. : 2214'

[*Page* 4, *clause* **3.1**(j)1 — Substitute '570' *for* '584'.

(*Page* 5, *clause* **4.1,** *line* 3) — Substitute '1 ppm' *for* '2 ppm'.

(Page 8, *clause* **6.3**) — Insert the following new clause after **6.3:**

'6.4 Incompatibles — Concentrated mineral acids, strong oxidizing agents and water.'

(CHD 8)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CODE OF SAFETY FOR PHTHALIC ANHYDRIDE

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(Continued on page 10)

Indian Standard
CODE OF SAFETY FOR PHTHALIC ANHYDRIDE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 15 July 1971, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

0.2 Phthalic anhydride, $C_6H_4(COO)_2O$, molecular mass 146 11, either in solid or in vapour form, is highly irritant especially on moist skin, or on mucous membrane as in the nose, throat and eyes. Phthalic anhydride vapour or dust may form an explosive mixture In solid or liquid form it will burn if ignited.

0.3 The purpose of this code is to ensure safety of personnel engaged in manufacture and or handling of phthalic anhydride in solid, liquid or vapour form.

0.4 The properties of phthalic anhydride listed under **3** have been taken from literature and have been included for information only. Moreover, these properties pertain to pure phthalic anhydride. However, for technical phthalic anhydride IS : 5158-1969* has been published.

0.5 In the preparation oi this code, assistance has been derived frorn Chemi--al Safety Data Sheet No. 61 'Phthalic anhvdride' issued by the Manufacturing Chemists' Association, Washington, USA and Chemical Hazard Information Series of Association of Casualty and Surety Companies, New York.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Specification for phthalic anhydride, technical.

†Rules for rounding off numerical values *(revised)*.

1. SCOPE

1.1 This standard describes the properties of phthalic anhydride, the nature of hazards associated with it, and essential information on storage, handling, packing, labelling, disposal of waste, cleaning and repairs of containers, selection and training of personnel, personal protective equipment and first-aid.

2. TERMINOLOGY

2.1 For the purpose of this standard, definitions given in IS : 4155-1966*, IS : 4167-1966† and IS : 5158-1969‡ shall apply.

3. PROPERTIES OF PHTHALIC ANHYDRIDE

3.1 The important properties of phthalic anhydride are as follows:

a) Physical state at normal temperature and pressure	Solid
b) Form	Crystaline needles or flakes. Also available in molten state
c) Colour	White in solid form, colourless in liquid form
d) Odour	Mildly irritating
e) Flash point:	
Open cup	16.5°C
Close cup	151°C
f) Boiling point	284.5°C
g) Vapour pressure at 96 5 C	1 mmHg
h) Melting point	131°C
j) Auto-ignition temperature	584°C
k) Corrosivity	None except in presence of moisture
m) Density:	
Solid	1.527 at 4°C
Liquid at melting point	1.21
n) Explosive limit	1.7 to 10.4 percent by volume in air
p) Flammability limit (dust cloud)	Flammable
q) Explosibility index	10
r) Minimum explosive concentration	16.5 mg/m^3
s) Solubility	Sparingly soluble in water Soluble in alcohol

---

*Glossary of terms relating to chemical and radiation hazards and hazardous chemicals.
†Glossary of terms relating to air pollution.
‡Specification for phthalic anhydride, technical.

4. HEALTH HAZARDS

4.1 Phthalic anhydride, in the form of vapour or dust is a local irritant to body tissues and more so in the presence of moisture when it gets converted to phthalic acid. A threshold limit value (TLV) of 2 ppm or 12 mg/m^3 for 8 hours work day and 40 hours work week, has been assigned by ACGIH*.

4.1.1 Workers who are handling phthalic acid or anhydride shall be under medical supervision. Special attention should be paid to asthma-like symptoms and skin sensitization. If any such symptoms are noticed it is suggested that the workers should be removed to another job; skin contact is to be avoided under all circumstances. Suitable clothing such as rubber hand protection is recommended. Pre-employment examinations are necessary so that persons with bronchial asthma, eczema or other allergic diseases are not exposed to phthalic anhydride.

4.2 Acute Toxicity

4.2.1 *Systemic Effects* — Phthalic anhydride is not acutely toxic and no systemic effects have been recognized.

4.2.2 *Local Effects*

a) *Effects of inhalation* — Phthalic anhydride in the form of vapour, fume or dust when inhaled causes irritation to nose, throat and upper respiratory tract resulting in coughing, sneezing, increased mucous secretion and a burning sensation in nose and throat.

b) *Effects on skin* — Phthalic anhydride is irritating to the skin especially when it is moist and the skin is exposed for a long period. If it is not washed off with water, reddening of the skin will result. The effect is severe if the skin contact is under the clothing such as gloves and shoes.

c) *Effects on eyes* — When phthalic anhydride in solid, dust or vapour form in high concentrations comes in contact with eyes it will produce marked irritation if not promptly removed by prolonged irrigation with water.

4.2.3 *Chronic Toxicity*

4.2.3.1 *Systemic effects* — No systemic effects have been recognized from repeated exposures.

4.2.3.2 *Local effects* — Repeated exposures by fumes or dust may result:

a) in contact and sensitization types of dermatitis,

b) in chronic irritation in case of eyes, and

c) in chronic congestion or ulceration of the nasal mucous membranes or attacks of bronchial asthma in individuals with a previous history of asthma if proper protection is not provided.

4.3 Fire Hazard — Molten and solid phthalic anhydride will burn if ignited and its dust forms explosive mixture with air at elevated temperatures. It can react with oxidizing materials. Water, dry chemicals or carbon dioxide can be used to fight fire.

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*American Conference of Governmental Industrial Hygienists, Ohio, USA.

5. HANDLING

5.1 Packing

5.1.1 Phthalic anhydride flakes can be packed in multiwalled paper bags with or without polyethylene liners as well as polythene-lined hessian bags containing from 20 to 200 kg as agreed to between the manufacturer and the purchaser.

5.1.2 Molten phthalic anhydride can be shipped in tank cars and trucks.

5.2 Labelling — All containers should bear the following label, in addition to, or in combination with, any other label required by statutes, regulations or ordinances:

CAUTION
PHTHALIC ANHYDRIDE
MAY CAUSE SKIN IRRITATION
AVOID PROLONGED OR REPEATED CONTACT WITH SKIN
AVOID BREATHING DUST
AVOID NAKED FLAME NEARBY

5.3 Unloading Tank-Cars and Tank-Trucks

5.3.0 *General* — All precautions noted below shall apply to both tank-cars and tank-trucks. Provision should be made for draining all portions of the unloading lines to the storage tank to eliminate bad spills.

5.3.1 Unloading operations should be carried out by trained personnel under adequate supervision with proper lighting (electric light with gas-proof socket and connections or portable approved flash light) No naked flame of any type is permitted. Smoking is strictly forbidden.

5.3.2 All tools used for unloading should be spark-resistant and tank-car or truck fittings should not be struck with tools or other hard objects.

5.3.3 Unloader should be present throughout the period of unloading operations until the unloading connections are detached.

5.3.4 Unloading track should be level, the hand-brake of car should be set and the wheels are blocked from the time the car is placed for unloading to the time the car is ready to be removed after all the connections arc disconnected. Metal 'CAUTION' boards should be placed before and after the car. Sign boards of size not less than 30 × 40 cm painted in blue and bearing the legend in white 'STOP. TANK-CAR CONNECTED' should also be displayed before and after the car.

5.3.5 The car should be properly bonded (electrical) before commencement of unloading operations and standard procedure in writing is to be issued for operational safety.

5.3.6 The cars arc insulated and provided with steam heating coils or jackets. To prevent rupture of the car when heat is applied to coils, either a lance extending from dome to bottom or *vice versa* is provided to melt a vent or welded external coils throughout the length of car around the sides are provided to melt the solid. In case the steam coils get blocked with solid phthalic anhydride owing to leak in coil, portable tank-car heater is to be used to melt the solid.

5.3.7 It is recommended that cars are unloaded through dome connections and inert gas pressure not exceeding 2 kg/cm^2 should be used to force material to the unloading pump. Air pressure should never be used to unload the cars through the dome in view of fire and explosion hazards.

5.3.8 Tank-cars are normally provided with inside or flush valves in addition to external jacketed valves or cocks. Care should be taken to see that all connections made to unload the car are tight before opening the external and flush valves. Similarly the valves should be closed tight before connections are removed after reloading.

5.3.9 In the event of leak in tank-car fittings suppliers should be intimated immediately.

5.4 Unloading Multiwall Paper Bags

5.4.1 Approved personal protective equipment should be worn.

5.4.2 Area for unloading bags should be provided with adequate exhaust fans to prevent accumulation of dust in the air and on surfaces in the area.

5.4.3 It is recommended that all empty bags are disposed off by burning in an incinerator.

6. STORAGE

6.1 General — Buildings where phthalic anhydride is stored should be well ventilated and provided with suitable exhaust fans; and vapour emanating from molten phthalic anhydride should be removed through high vent.

6.2 Location — Storage locations should be isolated from naked flames of all types. 'NO SMOKING' sign boards should be exhibited in the area.

6.3 Type of Construction — Sand blasted carbon steel tanks or stainless steel tanks are recommended depending on the end use. Tanks should be provided with vertical steam lance or coil in addition to heating coils or jacket to melt the solidified phthalic anhydride. Tanks should be vented to a safe area and the vent is to be steam jacketed or traced to prevent blockage of vent with phthalic anhydride. Tank is to be provided with temperature indicator and temperature is to be controlled well within 150°C.

7. SPILLS AND LEAKS

7.1 Spills of flaked or molten phthalic anhydride should be mopped up and collected immediately. Insulation soaked with phthalic anhydride should be promptly replaced by new insulation material to avoid fire hazard.

8. TANK AND EQUIPMENT CLEANING

8.1 Since phthalic anhydride forms phthalic acid with water, tanks which contain this chemical should be cleaned thoroughly with adequate caustic soda solution for neutralising and washed with water taking due safety precautions regarding handling of caustic soda.

8.2 It is very essential to carry out hot work in vessels or tanks under the immediate supervision of trained and authorized personnel after making sure that all safety conditions prescribed in the 'VESSEL ENTRY PERMIT' had been fulfilled.

9. WASTE DISPOSAL

9.1 Phthalic anhydride wastes are acidic and may be disposed off by dumping in special area isolated from ail operations and where no contamination of drinking water supply will be involved. The waste, if any, may be destroyed by safe incineration.

10. PERSONAL PROTECTIVE EQUIPMENT

10.1 Eye Protection — Spectacle type safety goggles with unperforated side shields may be used where continuous eye protection is needed. Where there is danger of phthalic anhydride contact with eyes it is essential to wear chemical safety goggles and such goggles should be carefully fitted by adjusting the nose piece and head band to ensure maximum protection and comfort.

10.2 Hand and Body Protection — Rubber hand-gloves and rubber aprons should be readily available and should be worn by workers before being permitted to handle phthalic anhydride especially in liquid form.

10.3 Head Protection — Safety helmets shall be used.

10.4 Foot Protection — Approved rubber safety shoes are recommended. When such shoes become wet with phthalic anhydride, they should be removed, cleaned and dried before wearing again to prevent burns on feet.

10.5 Respiratory Protection

10.5.1 Different types of apparatus are recommended depending upon the place of work and condition prevailing.

10.5.1.1 Self contained breathing apparatus which supplies air or oxygen from cylinders can be used but this type is not recommended for use in tanks or other confined spaces.

10.5.1.2 Positive pressure hose masks supplied by blowers can be used inside spaces where conditions will permit safe escape in the event of air supply failure.

10.5.1.3 Air line masks supplied from plant compressed air (free from lubricating oil vapours) can be used in space where conditions will permit safe escape. Such masks should be used in conjunction with suitable reducing or demand type valve, excess pressure relief valve and filters.

10.5.1.4 Industrial canister type gas masks fitted with proper canister for absorbing phthalic anhydride vapour can be used in spaces having a concentration of more than 2 percent by volume and a concentration of not less than 16 percent of oxygen by volume.

11. FIRST-AID

11.1 Skin Contact — The affected portion should be washed free of phthalic anhydride using large quantities of water and soap. After wash, sterile gauze may be applied. In case of repeated or prolonged exposure to phthalic anhydride resulting in dryness of skin use of lanolin base ointment is recommended after wash. Clothing and shoes affected by phthalic anhydride shall be removed, washed and dried before being used again. If skin comes in contact with molten phthalic anhydride, the material will solidify and form a crust. The adhering material should be removed by using sterile liquid paraffin. The burn is to be treated as in the case of thermal burn. Physician should examine all cases other than minor burns.

11.2 Contact with Eyes — If phthalic anhydride in any form comes in contact with eyes, they should be irrigated with copious amount of water for a minimum period of 15 minutes. It is recommended that, as a first-aid measure, it is permissible to apply 2 or 3 drops of 0.5 percent solution of pontocaine or some equally effective aqueous topical anesthetic. No attempt should be made to use a chemical neutralizer. Oily ointment should not be applied unless ordered by physician.

11.3 Ingestion — Physician should be called immediately. Vomiting should be induced by giving large quantities of warm salt solution and, if necessary, patient should be asked to tickle his throat by sticking his linger. Keep the patient comfortable and warm.

11.4 Inhalation — Patient should be removed immediately from exposure to fresh air. Irritation of throat and nose may be relieved by spraying or gargling with water. If patient is coughing or having difficulty in breathing, pure oxygen inhalation should be given by a trained nurse familiar with the proper administration of oxygen. Send for physician immediately.

(Continued from page 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	
Amount of substance	mole	

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOI	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A V
Electromotive force	volt	V	1 V = 1 W A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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